Section XXXXX

KeeSafety Keeline Horizontal Lifeline Fall Protection System

Note to Specifier



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General:
This specification is for Kee Safety’s KeeLine Horizontal Lifelines (HLLs). Each application of the HLL is specific to its location. Therefore, this specification needs to be modified to suit the project. Specific sections that need to be modified have a comment box (similar to this one) describing the action that needs to be taken.

About this Specification:
Currently, many fall protection companies do not follow best practice standards while designing HLL(s). Using the latest standards, this specification directs designs to conform to fall protection’s best practices

Product information:
The HLL is an advanced engineered system comprised of multiple components to protect workers along a specific path. HLL(s) can be installed in various configurations, allowing them to be used in fall restraint and fall arrest. Workers connect to the system using a Kee Safetys attachment device. The attachment device passes through the intermediate anchors, allowing the workers to remain connected, for the entire length of the system.

Kee Safety has completed most of the engineering on the KeeLine HLL. The system is intended for 3 workers in fall restraint and 2 workers in fall arrest. ANSI has recommends that all Fall Restraint systems be designed for fall arrest By following ANSI, the worst case loading is for 2 workers and the maximum number of users is 2 workers.

OSHA has determined that only Qualified Persons in fall protection can design HLL(s). If a HLL is not designed by a Qualified Person various critical may be overlooked leading workers and staff to a false sense of safety.

Questions:
If you have a question about this specification or have a general fall protection question, feel free to call Gravitec Systems (1-800-755-8455).

Removing Boxed Text:
Click on the Show/Hide button (paragraph symbol) on the menu bar (For more information go to the *Display Hidden Notes.doc* found within this flash drive).

# Part 1 General

## System Description

NOTE TO SPECIFIER:
There are many different applications for a HLL. This specification focuses on two applications: fall restraint and fall arrest.

Provide the recipient of this document with a clear understanding of the system’s purpose. If any information is unknown or varies, provide enough information so the bidders can clearly interpret your intended product.

A. Type of system required:
This specification is for Kee Safety’s Horizontal Lifeline. If a horizontal lifeline is not what you are looking for, please refer to our other specifications.

B. System location:
Where will the system be located (roof, tower, wall, etc…)?

C. Maximum number of workers on system at one time:
Kee Safety limits the number of workers on the KeeLine HLL to 2 workers in fall arrest. Will rescuers need to use this system if a person falls? If rescuers cause the system to be overloaded an additional system needs to be specified

D. Materials required for system:
Kee Safety’s primarily supplies all components with a 316 stainless steel.

E. Workers task while on the system:
What are workers doing while connected to the system? How are workers doing the task?

F. Type of fall protection required:
How will the workers be protected from the fall hazard? Will the workers never be able to reach the hazard (fall restraint)? Will the workers be allowed to have an arrested fall (fall arrest)?

G. Range of movement while on the system:
Some systems allow uninterrupted movement and other systems require more attention to the attachment device while on the system.

H. Additional Components:
Will you need any hardware to connect the workers to the system? How many attachment devices do you need?

I. Insurances required:
What insurances are required (e.g. Commercial Liability, Workers’ Comp., etc…)

### A. Type of system required: Horizontal Lifeline (HLL)

### B. System location: Roof/ Wall/ Tower/ Etc…

### C. Maximum number of workers on system at one time: Kee Safety limits the number of workers on the KeeLine HLL to 2 workers in fall arrest.

### D. Systems environmental exposure: What are the service conditions (indoors, outdoors, corrosive environment)? What materials will be required (steel, hot dip galvanizing, stainless steel, marine grade stainless etc…)?

### E. Workers task while on the system: Workers will walk along edge. Occasionally, workers are required to look over the edge. While walking, workers need to carry heavy objects.

### F. Type of fall protection required: Fall Restraint or Fall Arrest

### G. Range of movement while on the system: Uninterrupted movement throughout the entire length of the system

### H. Additional components: All attaching devices necessary for # workers.

### I. Insurances required: Commercial Liability and Workers’ Comp.

## 1.2 Related Sections

NOTE TO SPECIFIER
Delete any sections below not relevant to this project.
Add others sections as required, below are a few examples:

Section 08600 - Skylights
Section 11060 – Theater and Stage Equipment
Section 11140 – Vehicle Service Equipment
Section 11160 – Loading Dock Equipment
Section 11200 – Water Supply and Treatment Equipment
Section 11500 – Industrial and Process Equipment
Section 13120 - Pre-Engineered Structures
Section 13160 - Aquariums
Section 13165 - Aquatic Park Facilities
Section 13600 – Solar and Wind Energy Equipment
Section 15100 - Building Services Piping
Section 15700 – Heating, Ventilating, and Air Conditioning Equipment
Section 16700 - Communications

### A. Section 03300 - Cast-In-Place Concrete

### B. Section 03400 - Pre-Cast Concrete

### C. Section 05100 – Structural Metal Framing

### D. Section 05400 – Cold Formed Metal Framing

### E. Section 05310 - Metal Deck

### F. Section 06100 – Rough Carpentry

### G. Section 07510 - Built-Up Roofing

### H. Section 07700 - Roof Specialties and Accessories

### I. Section 11010 - Maintenance Equipment

## 1.3 References

NOTE TO SPECIFIER
Delete any sections below not relevant to this project; add others as required.

### A. Occupational Safety & Health Administration (OSHA)

#### 1. 29 CFR 1910.23(c) (1) & 29 CFR 1926.501(b) (1) - Occupational Health and Safety Standards General Industry & Construction: Duty to have fall protection

#### 2. 29 CFR 1926.502(d) (15) (i-ii) - Safety and Health Regulations for Construction: Anchor Design Requirements

#### 3. 29 CFR 1910.66 I(c) (10), I (d) (iv), II (2) - General Industry: Anchor Design Requirements

### B. American National Standards Institute (ANSI)

#### 1. Z359.0 [2012] – Definitions and Nomenclature Used for Fall Protection and Fall Arrest.

#### 2. Z359.1 [2007] – Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components

#### 3. Z359.2 [2007] – Minimum Requirements for a Comprehensive Managed Fall Protection Program

#### 4. Z359.3 [2007] – Safety Requirements for Positioning and Travel Restraint Systems.

#### 5. Z359.4 [2007] – Safety Requirements for Assisted-Rescue and Self-Rescue Systems, Subsystem and Components.

#### 6. Z359.6 [2009] – Specifications and Design Requirements for Active Fall Protection Systems.

#### 7. Z359.12 [2009] – Connecting Components for Personal Fall Arrest Systems

#### 8. Z359.13 [2009] – Personal Energy Absorbers and Energy Absorbing Lanyards

#### 9. Z359.14 [2012] – Safety Requirements for Self-Retracting Devices for Personal Fall Arrest and Rescue Systems.

### C. Materials, Bolting, Finishing: American Society of Testing Materials (ASTM)

#### 1. A36 - Standard Specification for Carbon Structural Steel.

#### 2. A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

#### 3. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

#### 4. A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

#### 5. A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

#### 6. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

#### 7. A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

### D. American Welding Society (AWS) D1.1/D1 - Structural Welding Code – Steel

### E. Design Standards

#### 1. American Institute of Steel Construction (AISC) 325-11 [14th ed.] – Steel Construction Manual

#### 2. National Design Specification (ANSI/NDS) [2012] – Wood Construction Manual

#### 3. International Building Code (IBC) [2012] – Building Design Manual

#### 4. American Society of Civil Engineers (ASCE/SEI) 7-10 [2010] – Minimum Design Loads for Buildings and Other Structures

#### 5. American Concrete Institute (ACI) 318-11 Building Code Requirements for Structural Concrete.

## 1.4 Performance

### A. System shall comply with 1.1 System Description

### B. Performance Requirements

#### 1. The Fall Protection System shall be designed to allow users to walk the entire length of the system without having to disconnect from the system to pass through intermediate support points. The system shall be designed to support 2 users in case of a fall and to prevent the users from free falling more than 6 feet. All components shall be designed by the fall protection system supplier and shall meet the applicable requirements of ANSI and applicable OSHA regulations.

#### 2. Structural Performance:

##### a. Structure supporting Kee Safetys Horizontal Lifeline system must be capable of withstanding design loads as required by governing regulations and codes. Where component design loads are specified herein, they represent design minimum requirements.

##### b. All horizontal lifelines shall be designed with a minimum 2:1 safety factor.

## 1.5 Design

### A. Design Requirements

#### 1. Fall protection horizontal lifelines shall comply with current applicable OSHA, ANSI, and state regulations and standards.

#### 2. The fall protection system and any supporting structure shall be designed by:

####  Kee Safetys Phone: 1-800-851-5181100 Stradtman St Website: [www.KeeSafetys.com](http://www.KeeSafetys.com)Buffalo, NY 14206 E-mail: info@KeeSafetys.com.

####  Gravitec Systems Inc. Phone: 1-800-755-845521291 Urdahl Road NW, Website: www.gravitec.comPoulsbo, WA 98370-7124 E-mail: solutions@gravitec.com.

#### 3. General Requirements:

##### a. Horizontal lifelines shall be designed and installed, under the supervision of a Qualified Person, as part of a complete personal Fall Protection system.

##### b. The horizontal lifeline must be level (less than a 5% grade).

##### c. Engineers shall, at minimum determine the performance of the system when a fall occurs on the shortest span (largest forces) and the longest span (largest total fall distance) in the system.

##### d. Keeline upright post and/or absorbers shall not be used to limit the maximum arrest force of the worker. Keeline upright post and/or absorbers shall be used only to control or reduce the maximum arrest load on the structure.

##### e. Anchorages for horizontal lifelines systems shall be verified and designed, prior to use, by a Qualified Person with experience and trained in designing and using horizontal lifelines systems.

##### f. HLL(s) shall satisfy the seismic conditions for nonstructural components as described by ASCE/SEI 7 and the most current edition of the IBC. No exceptions can be taken if the system is required to function for life-safety purposes after an earthquake.

##### g. The fall arrest system shall consist of a stainless steel safety cable attached to the structure. The cable shall be continuous or shall have swaged splices, which allow the user to pass without disconnecting from the system.

##### h. Brackets and supports shall be attached to the structure with appropriate anchors of proper size to adequately support the intended loaded.

i. The HLL(s) shall comply with Kee Safetys design requirements.

Restraint These systems protect workers from nearby fall hazards by restricting their movements. The equipment and components can be the same as those used in fall arrest systems, but the performance of a fall restraint system eliminates any potential for impact loading on the user or system components.

#### 4. Restraint HLL(s) shall be designed per ANSI Z359.2 & ANSI Z359.6:

##### a. The HLL(s) shall prevent workers from reaching and falling into any open hole or off the edge of a working surface.

##### b. The horizontal lifeline shall comply with the requirements for fall arrest horizontal lifelines as indicated in this document.

##### c. Where a worker is using a full body harness the force on the worker’s body shall not exceed 400 lbs.

##### d. Keeline upright post and/or absorbers may be used in travel restraint systems; provided that the engineer has determined that the restraint forces will not cause the upright post and/or absorbers to deploy and ensures that the deflection of the wire rope in combination with other deformations of the restraint system will not permit the worker(s) to reach the fall hazard.

##### e. The use of fall restraint systems shall be limited to surfaces at or less than a slope of 4:12 from the horizontal. This is so a fall will not result in dynamic loading on the fall restraint system or where the authorized person could end up being suspended vertically from the system.

Arrest Often, the nature or location of work forbids the use of fall restraint systems. If so, fall arrest systems are the next best option. In these systems, the personal protective equipment is configured to allow a fall. However, the worker’s fall is arrested before striking the ground or other hazardous obstacles.

#### 4. Fall Arrest HLL(s) shall be designed per ANSI Z359.2 & ANSI Z359.6:

##### a. The selection, design, and installation of fall arrest horizontal lifelines shall be performed under the supervision of a Qualified Person.

##### b. Fall arrest horizontal lifelines shall have the strength capable of sustaining static loads applied to the wire rope of at least two times the maximum arresting force.

##### c. When more than one user is attached to a horizontal lifeline, the load on the lifeline can be determined using either lumped mass or sequential fall as described in ANSI Z359.6 [6.3.6]

##### d. The swing fall shall comply with ANSI Z359.6 [5.3]

##### e. The clearance safety margin shall comply with ANSI Z359.6 [7.2.6.2]

### B. Sub-System Requirements

#### 1. Harnesses and Vertical Lifelines (VLLs) used with the system shall comply with ANSI Z359.1

#### 2. Connecting Components (carabiners and snaphooks) used with the system shall comply with ANSI Z359.12

#### 3. Energy Absorbing Lanyards (EALs) used with the system shall comply with ANSI Z359.13

4. Self Retracting Lifelines (SRLs) used with the system shall comply with ANSI Z359.14

### C. Horizontal lifelines shall be used exclusively for their designed use and shall be marked to prevent other uses.

### D. The design shall take into consideration the potential uses of and loads on the horizontal lifeline, in order to facilitate the prompt rescue of workers who may fall while attached to the system.

## 1.6 Submittals

NOTE TO SPECIFIER
Check section number for continuity

### A. Submit under provisions of Section ##### – Submittal Procedures

### B. Product Data: Kee Safetys’ data sheet on each product to be used, including:

#### 1. Preparation instructions and recommendations.

#### 2. Storage and handling requirements and recommendations

#### 3. Installation methods

### C. Drawings and Calculations:

#### 1. Drawings:

##### a. Show the layout of the system including where the system is located and the complete assembly of all components.

##### b. Include a specification of the number, location, and qualifications of workers using the system.

##### c. Clearly specify the equipment dimensions, materials, fabrication details, hardware, and installation instructions.

#### 2. Calculations:

##### a. Calculations shall be prepared under the supervision of a registered Professional Engineer and Qualified Person.

##### b. Include a statement defining the type of system and indicating that the design is in accordance with the requirements of ANSI Z359.6.

#### 3. The Professional Engineer who oversaw the design of the system shall affix their professional seal to each drawing and calculation package issued.

### D. Operation and Maintenance Data shall be prepared per Z359.2 & ANSI Z359.6:

#### 1. Include complete list of equipment replacement parts; identify each entry with the equipment description and part numbers.

#### 2. Include technical information for servicing equipment.

#### 3. Include legible “as-constructed” drawings of the installed system.

#### 4. Include installation date and system owner’s name and address.

#### 5. Include detailed operating procedures:

##### a. Written by a Qualified or Competent Person.

##### b. Identifying the horizontal lifelines location

##### c. Stating any safety precautions that shall be followed during access and egress.

##### d. Describing the limitation on use of system: maximum load, designated equipment, required clearance and maximum number of persons permitted to be attached to the system at one time.

##### e. Instructions for inspection, maintenance, and retirement of the system and all of its components, including how often inspection and maintenance are to be performed and a description of the qualifications required for persons performing these tasks.

##### f. Procedure for inspection:

###### I. Required or recommended inspection intervals.

###### II. Detailed instruction for inspecting each component of the system.

###### III. Description of acceptance or rejection criteria, including retirement criteria, of each component of the system.

###### IV. Fall protection procedures shall include a requirement that any incidents, including accidents or near misses, be investigated to determine if procedures can be improved.

#### 6. Provide or direct the owner of the system or the employer of the workers using the system to develop and implement a rescue plan before the system is used.

## 1.7 Quality Assurance

### A. Single Source: Obtain all materials and equipment required under this section from a single supplier.

### B. Designer/Installer Qualifications: Engage a single firm to assume undivided responsibility for the design and fabrication of all fall protection system components. Firm shall have a minimum of 5 years documented experience in the fabrication of such components similar to that required for this project. Additionally, the firm shall have a minimum of 5 years documented experience in the installation of such components and who offers a regular inspection and maintenance service on such systems.

### C. Design Engineer: Employ a firm with a minimum of 10 years experience designing fall protection systems with a minimum of 5 systems installed in the previous 12 months. Who employs a registered Professional Engineer (PE), with evidence of being the principal PE on at least 3 fall arrest systems which have been in use for no less than 1 year prior to bid closing date.

### D. Professional Engineer and Fall Protection Qualified Person: Shall oversee the fall protection systems’ design, such that all component items meet the “Structural Performance” requirements, including sizing and spacing of all attachments to the building structure and verify the design is compliant with all applicable OSHA and ANSI standards. Additionally, they must prepare, stamp and sign all required calculations; while also approving the system designer’s drawings

### E. Welding to be executed by certified welders in accordance with AWS requirements.

## 1.8 Delivery, Storage & Handling

### A. Material delivery shall be coordinated with all effected entities.

### B. Storage and Protection:

#### 1. Store originally packaged materials in a cool, dry, and protected location.

#### 2. Materials shall be in new condition and show no signs of damage.

## 1.9 Sequencing

### A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

## 1.10 Warranty

### A. Manufacturer's standard year warranty for materials and workmanship.

# Part 2 Products

## 2.1 Manufacturers

### A. Manufacturers shall comply with the *Quality Assurance* section of this documentation.

### B. All supporting structure which connects the horizontal lifeline to the super structure shall be designed by:

####  Gravitec Systems Inc. Phone: 1-800-755-845521291 Urdahl Road NW, Website: www.gravitec.comPoulsbo, WA 98370-7124 E-mail: solutions@gravitec.com.

## 2.2 pRODUCTS

### A. Kee Safetys100 Stradtman StBuffalo, NY 14206

## 2.3 Materials

NOTE TO SPECIFIER
Delete any sections below not relevant to this project; add others as required.

### A. Product

#### 1. The system shall be a complete and turnkey complying with the performance and design criteria of this document.

#### 2. The HLL(s) shall be the product of Kee Safety.

#### 3. Components: All system connectors, cables and bolts shall be stainless steel Type 316. Fabricated supports required for additional support may be carbon steel with a corrosion resistant coating. However a faying surface shall be used to prevent galvanic reactions.

##### 4. Post Base Plate Connectors: Provide complete with required components for weatherproof mounting to the following surfaces:

NOTE TO SPECIFIER
Select the required roof surface(s) from the following paragraphs and delete the ones not required.

##### a. Standing Seam Roof Type.

##### b. Composite Ribbed Roofing Type.

##### c. Metal Roofing Type.

##### d. Insulated Roof Deck Type.

##### e. Concrete Deck Type.

##### f. Timber Deck Type.

g. Non-Penetrating.

#### 5. The Kee Safetys Fall Protection System shall be attached to the supporting structure with appropriate fasteners. The fasteners shall be designed to support a load on the fall protection system of 2 times the maximum design load without failure.

#### 6. Provide all designed sub-system items per Section 1.5 (B) of this document.

#### B. Supporting Structure

#### 1. Structural Components shall comply with the applicable standards:

##### a. Structural Steel: ASTM A36

##### b. Structural Tubing: ASTM A500 Grade B

##### c. Structural Bars, Plates, Shapes, and Sheet Piling: ASTM A6

##### d. Piping: ASTM A53

#### 2. Fasteners shall comply with the applicable standards:

##### a. Structural Bolts: ASTM A325

##### b. Alloy-Steel and Stainless Steel Bolting: ASTM A193

#### 3. Flashing and Sealing Material shall comply with the applicable standards:

#### 4. Material substitutions shall be better than or equal to the requirements found in this section.

#### 5 Fabrication

##### a. Fabricate work true to dimension, square, plumb, level, and free from distortion or defects detrimental to performance.

##### b. Coordinate the system with supporting structure.

##### c. Welding:

###### I. AWS D 1.1 as applicable.

###### II. If Butt welds are used, then surplus welding material is to be ground off to ensure exposed surfaces are smooth. Fillet welds shall not be ground.

###### III. Slag is to be removed from the materials surface.

NOTE TO SPECIFIER
Delete any sections below not relevant to this project; add others as required.

#### 6 Finishes

##### a. Hot Dipped Galvanizing: Comply with ASTM A123.

##### b. Powder Coat: Safety Yellow

## 2.4 Horizontal lifeline Design

### A. Horizontal lifeline design shall comply with the *Design Requirement* section of this document.

### B. Steel design shall comply with AISC 14th ed.

### C. Wood design shall comply with ANSI/NDS [2005]

### D. Concrete design shall comply with ACI [2008]

### E. Fall protection systems attached onto an existing or new structure shall comply with IBC [2009] and ASCE/SEI [2010]

# Part 3 Execution

## 3.1 Installation

### A. Installation shall be performed by:

###  Gravitec Systems Inc. Phone: 1-800-755-845521291 Urdahl Road NW, Website: www.gravitec.comPoulsbo, WA 98370-7124 E-mail: solutions@gravitec.com.

### B. Install in accordance with approved shop drawings and manufacturer’s instructions.

### C. The Kee Safety’s Fall Protection System shall be installed under the direction of manufacturer’s authorized trained personnel and under the supervision of a Qualified Person

### D. Install anchorages and fasteners in accordance with their manufacturer’s recommendations to obtain the allowable working loads published in the product literature and in accordance with this specification.

### E. Do not load or stress the Kee Safety’s Fall Protection System until all materials and fasteners are properly installed and ready for service.

### F. Where bolting is used for fastening, no fewer than three threads are to be exposed and the nut is to be positively locked using a thread-locking fluid or the double nutting technique.

### G. Dissimilar materials with greater than 0.15V shall be separated by a faying surface.

## 3.2 Field Quality Control

### A. After the Kee Safetys Fall Protection System is installed and properly tensioned, Kee Safetys approved authorized Qualified or Competent Person shall inspect and operate the system and shall make all final adjustments for proper operation.

## 3.3 Adjustments And final Inspection

### A. Verify that all manufactured units have been installed in accordance with specifications and details, and will function as intended. Adjust any items where necessary to ensure proper operation.

### B. Provide a complete drawing set with any revisions to the design or layout of the horizontal lifelines during installation.

NOTE TO SPECIFIER
While deliberating on deleting or adding to the training portion of this specification, note that OSHA requires that each employee is trained, as necessary, by a Competent Person qualified in the nature of the hazard and the correct procedure for the installed systems (1926.503a2). Allowing the contractor to provide training is an excellent way to build into a managed fall protection program. It is acceptable to delay training until the employees are available.

## 3.4 Operator Training

### A Provide a minimum of 4 hours of operator training after system has been installed. Training is to be for the users of the system conducted at the installation site.

## 3.5 Maintenance, Inspection and Testing

### A. Provide manufacturer maintenance, inspection and testing instructions.

### B. Provide documentation that is consistent with applicable OSHA and ANSI standards.

End of Section